miles. It is also extremely probable that telescopic meteors are at yet greater elevations than the brighter forms of these bodies visible to the naked eye.

Bristol: 1887, *December.*

On Invisible Stars of Perceptible Actinic Power.
By Dr. R. de Kövesligethy.

(*Communicated by the Astronomer-Royal.*)

With reference to his well-known photographs of the small star in the annular nebula in *Lyra*, M. von Gothard was so kind as to call my attention to the possibility of a theoretical treatment of the question as to the existence of invisible stars of perceptible actinic power. The question may be generally resolved without the aid of any explicit law of emission. As I think the results may be of some importance as bearing upon the proposed photographic work shortly to be undertaken, I may be allowed to briefly point them out.

I exclude all stars of *merely* homogeneous ultra-violet light, not only because these cases may be very rare, but chiefly because the invisibility of such a star would be of no further account. I select rather stars of well-developed continuous spectra. Then, to speak briefly, I consider two methods of photometric observations as *different* when they select out of the spectrum a group of rays between *different* limits of wave-length. Thus eye observations and photographs of stars are regarded as different, the former limiting the star's spectrum between the Fraunhofer lines H and A, and the latter between about P and *b*. The influence of different sensibility of the two methods may be omitted, for it does not alter at all the following theoretical theses:—

(1) For two proposed methods of observation there exists at least one substance giving a continuous spectrum such that the total intensity of the light between defined limits is the same by both methods, or conversely.

(2) For any substance giving a continuous spectrum there are at least two methods of observation for which the intensity of the light within defined limits has the same value.

The theorem is evidently demonstrated if I could prove that the emission function contains at least two parameters not simultaneously eliminable.

Let I be the intensity of the ray of wave-length λ, θ the absolute temperature, $z_1, z_2 \ldots z_n$ certain quantities depending

partially or totally upon the temperature and substantial qualities. Then generally we have

$$I = f(\lambda, \theta, z_1, z_2 \dots z^n).$$

That the number of parameters is at least two, which are not simultaneously eliminable, i.e. are not replaceable in the above equation by a single parameter, θ by virtue of a relation

$$\theta = \phi(\theta, z_1, z_2 \dots z_n)$$

may be proved as follows.

According to the law of Clausius (Ueber die Concentration von Wärme u. Lichtstralen, " Pogg. Ann." cxxi. pag. i) the emission of absolutely opaque bodies in different media is proportional to the square of the refractive index, and as absorption proves independent of the surrounding medium we may say the same for any emission at all. If there were now but one parameter in the emission function, or if, when more, they were simultaneously eliminable, we should have the equation

$$n^2 f(\lambda, \theta) = f\left(\frac{\lambda}{n}, \theta\right),$$

which we could differentiate to θ, to obtain the law for a body physically similar, and eliminate θ from the two equations. The result would be

$$F(\lambda, n) = 0,$$

i.e. the equation of relative dispersion of the two media *independent* of substantial qualities. As this equation is absurd the supposition must be false; there are at least two independent parameters in the emission function.

Now let λ_1 and λ_2, λ^1 and λ^2 be the limiting wave-lengths between which two different methods of photometric observation give a continuous spectrum with the intensities L_1 and L^1, which may be quite independent of each other; then we have the following pair of simultaneous equations:

$$\int_{\lambda_1}^{\lambda_2} f(\lambda, \theta, z_1, z_2 \dots z_n) d\lambda = L_1$$

$$\int_{\lambda^1}^{\lambda^2} f(\lambda, \theta, z_1, z_2 \dots z_n) d\lambda = L^1$$

a solution of which, according to the demonstrated theorem, can always be found, since the members on the left contain at least two arbitrary parameters. The only conditions to which L_1 and L^1 are subject, are

$$\int_0^\infty f(\lambda, \theta, z_1, z_2 \dots z_n) d\lambda > L_1,\ L^1 > 0.$$

When L_1 is smaller than the smallest perceivable intensity for

eye observation, L[1] greater than the least sensibility of photographic plates, we have M. von Gothard's case with the *Lyra* star; and since the possibility of the existence of such stars may be also proved theoretically, M. von Gothard's opinion that there might be found still more of these interesting objects may easily be verified during the general photographic survey of the heavens.

Budapest: January 12, 1888.
Meteorologische Centralanstalt.

Spectroscopic Results for the Motions of Stars in the Line of Sight, obtained at the Royal Observatory, Greenwich, in the year 1887. No. XI.

(*Communicated by the Astronomer Royal.*)

The results here given are in continuation of those printed in the *Monthly Notices*, vol. xxxvi. p. 318, vol. xxxvii. p. 32, vol. xxxviii. p. 493, vol. xli. p. 109, vol. xlii. p. 230, vol. xliii. p. 81, vol. xliv. p. 89, vol. xlv. p. 330, vol. xlvi. p. 126, and vol. xlvii. p. 101. The observations were made with the "half-prism" spectroscope, one "half-prism" with a dispersion of about 18½° from A to H being used throughout. A magnifying power of 14 was employed.

The cylindrical lens has always been used in front of the slit as in the observations made previously to 1881 and since. The observations of the Moon and of the sky have been made as a check on the general accuracy of the results.

The day specified in the first column is the civil day, and the hour is that of Greenwich civil time, commencing at Greenwich mean midnight, and reckoning from 0 to 24 hours.

The observations were made by Mr. Maunder throughout.

Motions of Stars in the Line of Sight in Miles per Second, observed with the Half-prism Spectroscope.

(+ denotes Recession; − Approach.)

Date. 1887.			No. of Meas.	Line.	Earth's Motion in miles per sec.	Concluded Motion of Star. Meas.	Estimd.	Remarks.
						α Andromedæ.		
		h						
Sept.	1	0	2	F	− 9·2	−23·0	−26·0	Spectrum fairly steady.
Oct.	14	23	2	F	+ 2·5	− 5·9	− 7·1	Spectrum steady but rather faint.
	19	21	2	F	+ 3·9	−26·1	−26·8	Definition fair.
	21	22	4	F	+ 4·5	−24·2	−25·1	Spectrum fairly steady.
						β Cassiopeiæ.		
Oct.	19	22	2	F	− 1·5	+ 7·9	+ 7·6	Measures very rough.